USGS

WATER RESOURCES RESEARCH GRANT PROPOSAL

1. **Title:** Cryptosporidium parvum: fate of oocysts in soil.

2. **Focus Categories:** ECL, NPP, WQL

3. **Keywords:** Crytosporidium, Pathogens, Public Health, Water Quality Control, Soil Microbiology, Surface Drainage, Land Use, Pollutants, Ecosystems, Dairy Waste Management, animal Waste, Agriculture, Contaminant Transport

4. **Duration:** September 1, 1997 through August 31, 1999

5. **Federal Funds Requested:** $70,000

6. **Non-Federal (matching) Funds Pledged:** $160,028

7. **Principal Investigators:**

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8. **Congressional District:** 26

9. **Statement of critical regional or State water problems:**

The State of New York is the third largest dairy producing state in the nation with a population of some 710,000 milking cows. Dairy calves are known to be commonly infected with *Cryptosporidium parvum* during the first month of life. Each infected calf sheds billions of the oocyst transmission stage in its feces while infected. These oocysts are highly resistant to environmental extremes and have been found to be ubiquitous in raw surface waters (LeChavellier and Norton, 1995). This is of significant concern in New York, where the water supply of New York City is surrounded by many dairy farms and also represents the largest unfiltered water supply in the nation.

The phenomenally large theoretical number of oocyst passed in the feces of calves each year represents a serious threat to the health of the population of New York City. At the same time, the apparent lack of water associated disease in the City would indicate that the risk is significantly reduced or removed by some as of yet undetermined set of environmental barriers or decontaminating elements. The water supply system of New York City is currently functioning under a filtration avoidance granted by the United States Environmental Protection Agency. The potentialof oocysts of *Crytosporidium parvum* from dairy cattle entering the water supply is perceived as on of the major threats to the residents of New York City. Currently, however, there is no information on the

survial of oocysts in other than water, and we know nothing of the fate ofoocysts as they move from calf hutches to the water supply. Information describing the fate of oocysts in the field is essential to the implementation of informed public policy, and until we know more about the fate of these oocysts in the environment, we cannot but guess what methods are either best or most cost-effective for protecting consumers from potential infection.

10. **Statement of results or benefits:**

This work will investigate how the oocysts of *Cryptosporidium parvum* survive within surface soils. The ulitmate goal of our research is to describe how the oocysts of this pathogen move within soils and surface water and the ultimate fate of the oocysts that contaminate the watershedenvironment. However, such a broad-scoped project is much too large to be considered in a single proposal, thus, this proposal will concentrate on a only one aspect of the fate and transport of these pathogens, i.e., the fate of oocysts in the soils of a watershed farm. The specific aims of this research are to examine oocyst survival under specified laboratory conditions that simulate environmental conditions in the watershed and under field conditions on a farm in the New York Watershed. Survivability will be determined by placing chambers containing sentinel oocysts in soils. These chambers will then be maintained in soils in the laboratory and in soils of the selected farm. In the laboratory, environmental conditions of the soils surrounding the sentinel chabers will be manipulated while in the field, environmental conditions will be monitored. In the laboratory, the environmental components of the soils that will be manipulated will be soil type and organic content, pH, temperature, and moisture content. The field conditions that will be monitored will include: soil classification, chemical analysis, pH, ammonia concentrations, temperature, and moisture content.

It is expected that this work will reveal how long oocysts actually survive in the environment and give actual inactication rates (decay rates) for model calculations of survival kinetics. The survival of the oocysts can then be used to answer several questions relative to the transport and fate of oocysts. The development of meaningful decay curves will allow for an indication of what the loading rate represented by calves truly means relative to the potential threat to the water supply. These decay data, generated for several major soil classes, will also provide some indication as to which soils provide the greatest risk for long term survival of the oocyst in nature. The work on the farm will give some indication of how the oocysts survive under field conditions relative to the actual watershed setting. It will also provide validity to the decay data generated within the laboratory. Future work is planned to investigate the movement of oocysts through the soil on farms, but initially, and perhaps more importantly, it is important to ascertain for how long oocysts can survive in the soil.